

Integrated Rate Law

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- This law is used when you are given _____ & _____
- Yesterday (for the differential rate law) you were given a graph of concentration & rate

Rate Law Summary

TABLE 12.6 Summary of the Kinetics for Reactions of the Type $aA \rightarrow$ Products That Are Zero, First, or Second Order in $[A]$

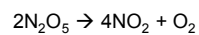
	Order		
	Zero	First	Second
Rate Law:	Rate = k	Rate = $k[A]$	Rate = $k[A]^2$
Integrated Rate Law:	$[A] = -kt + [A]_0$	$\ln[A] = -kt + \ln[A]_0$	$\frac{1}{[A]} = kt + \frac{1}{[A]_0}$
Plot Needed to Give a Straight Line:	$[A]$ versus t	$\ln[A]$ versus t	$\frac{1}{[A]}$ versus t
Relationship of Rate Constant to the Slope of Straight Line:	Slope = $-k$	Slope = $-k$	Slope = k
Half-Life:	$t_{1/2} = \frac{[A]_0}{2k}$	$t_{1/2} = \frac{0.693}{k}$	$t_{1/2} = \frac{1}{k[A]_0}$

Determining the order:

- You will be given a chart of concentrations and time
- Make another column for _____ and _____
- Use a few data points to find the slope of $[A]$ vs time
- Do the same for $\ln[A]$ vs time
- Do the same for $1/[A]$ vs time
- The one that gives the straightest line gives the reaction order

Example

Determine the rate law & the value of k for the following reaction:



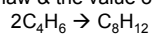
[N ₂ O ₅]	Time (s)
0	0
0.0707	50
0.0500	100
0.0250	200
0.0125	300
0.00625	400

½ life

- Time it takes for ½ the reactant to be gone
- What was the ½ life for the last problem?

Example

Determine the rate law & the value of k for the following reaction:



[C ₄ H ₆]	Time (s)
0.01	0
0.00625	1000
0.00467	1800
0.00370	2800
0.00313	3600
0.00270	4400
0.00241	5200
0.00208	6200

Example

- What is the ½ life for the last reaction?

Another example

- A 1st order reaction is 38.5% complete in 480 seconds
 - a. Calculate the rate constant
 - b. Calculate the value of the $\frac{1}{2}$ life
 - c. How long will it take for the reaction to go 25%
 - d. 75%
 - e. 95%

Last example

- If the $\frac{1}{2}$ life is 45 seconds, how much is left after 225 seconds?